No. 200500243

THE UNITED STATES OF AMERICA

TO ALL TO WHOM THESE PRESENTS SHALL COME:

Oklahoma Agricultural Experiment Station (OAES)

Whereas, THERE HAS BEEN PRESENTED TO THE

Secretary of Agriculture

AN APPLICATION REQUESTING A CERTIFICATE OF PROTECTION FOR AN ALLEGED DISTINCT VARIETY OF SEXUALLY REPRODUCED, OR TUBER PROPAGATED PLANT, THE NAME AND DESCRIPTION OF WHICH ARE CONTAINED IN THE APPLICATION AND EXHIBITS, A COPY OF WHICH IS HEREUNTO ANNEXED AND MADE A PART HEREOF, AND THE VARIOUS REQUIREMENTS OF LAW IN SUCH CASES MADE AND PROVIDED HAVE BEEN COMPLIED WITH, AND THE TITLE THERETO IS, FROM THE RECORDS OF THE PLANT VARIETY PROTECTION OFFICE, IN THE APPLICANT(S) INDICATED IN THE SAID COPY, AND WHEREAS, UPON DUE EXAMINATION MADE, THE SAID APPLICANT(S) IS (ARE) ADJUDGED TO BE ENTITLED TO A CERTIFICATE OF PLANT VARIETY PROTECTION UNDER THE LAW.

NOW, THEREFORE, THIS CERTIFICATE OF PLANT VARIETY PROTECTION IS TO GRANT UNTO THE SAID APPLICANT(S) AND THE SUCCESSORS, HEIRS OR ASSIGNS OF THE SAID APPLICANT(S) FOR THE TERM OF TWENTY YEARS FROM THE DATE OF THIS GRANT, SUBJECT TO THE PAYMENT OF THE REQUIRED FEES AND PERIODIC REPLENISHMENT OF VIABLE BASIC SEED OF THE VARIETY IN A PUBLIC REPOSITORY AS PROVIDED BY LAW, THE RIGHT TO EXCLUDE OTHERS FROM SELLING THE VARIETY, OR OFFERING IT FOR SALE, OR REPRODUCING IT, OR PORTING IT, OR EXPORTING IT, OR CONDITIONING IT FOR PROPAGATION, OR STOCKING IT FOR ANY OF THE E PURPOSE , OR CONDITIONING IT FOR PROPAGATION, OR STOCKING IT FOR ANY OF THE ABOVE SE, OR USING IT IN PRODUCING A HYBRID OR DIFFERENT VARIETY THEREFROM, TO THE EXTENT D BY THE PLANT VARIETY PROTECTION ACT. IN THE UNITED STATES SEED OF THIS VARIETY (1) E SOLD BY VARIETY NAME ONLY AS A CLASS OF CERTIFIED SEED AND (2) SHALL CONFORM TO THE NUM ENERATIONS SPECIFIED BY THE OWNER OF THE RIGHTS. (84 STAT. 1542, AS AMENDED, 7 U.S.C. 2321 ET SEQ.

WHEAT, COMMON

'Endurance'

In Testimony Whereof, I have hereunto set my hand and caused the seal of the Plant Variety Protection Office to be affixed at the City of Washington, D.C. this fifth day of July, in the year two thousand and six.

Attest:

Commissioner
Plant Variety Protection Office
Agricultural Marketing Service

Secretary of Agriculture

REPRODUCE LOCALLY. *Include form number and date on all reproductions*

Form Approved - OMB No. 0581-0055

U.S. DEPARTMENT OF AGRICULTURE
AGRICULTURAL MARKETING SERVICE
SCIENCE AND TECHNOLOGY - PLANT VARIETY PROTECTION OFFICE

APPLICATION FOR PLANT VARIETY PROTECTION CERTIFICATE
(Instructions and information collection burden statement on reverse)

The following statements are made in accordance with the Privacy Act of 1974 (5 U.S.C. 552a) and the Paperwork Reduction Act (PRA) of 1995.

Application is required in order to determine if a plant variety protection certificate is to be issued (7 U.S.C. 2421). Information is held confidential until certificate is issued (7 U.S.C. 2426).

1. NAME OF OWNER
Oklahoma Agricultural Experiment Station (OAES)

2. TEMPORARY DESIGNATION OR EXPERIMENTAL NAME
OK94P549-11

3. VARIETY NAME
ENDURANCE

4. ADDRESS *(Street and No., or R.F.D. No., City, State, and ZIP Code, and Country)*
Oklahoma State University
139 Ag Hall
Stillwater, OK 74078

5. TELEPHONE *(include area code)*
(405) 744-5398

6. FAX *(include area code)*
(405) 744-5269

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PVPO NUMBER
20050243

FILING DATE
May 6, 2005

7. IF THE OWNER NAMED IS NOT A "PERSON", GIVE FORM OF ORGANIZATION *(corporation, partnership, association, etc.)*
Public University

8. IF INCORPORATED, GIVE STATE OF INCORPORATION

9. DATE OF INCORPORATION

10. NAME AND ADDRESS OF OWNER REPRESENTATIVE(S) TO SERVE IN THIS APPLICATION. *(First person listed will receive all papers)*

~~Dr. D.C. Coston~~
~~Assoc. Director-OAES~~
Dr. Robert I. Westerman
Interim Associate director - OAES
Oklahoma State University
139 Ag Hall
Stillwater, OK 74078

FEES RECEIVED

FILING AND EXAMINATION FEES:
$ 3652.00
DATE 5/06/2005

CERTIFICATION FEE:
$ 768.00
DATE 4/20/2006

MAY 3/16/06

11. TELEPHONE *(Include area code)*
(405) 744-5398

12. FAX *(Include area code)*
(405) 744-5269

13. E-MAIL robert.i.westerman@okstate.edu
~~dcoston@okstate.edu~~

14. CROP KIND *(Common Name)*
Hard Red Winter Wheat

16. FAMILY NAME *(Botanical)*
Poaceae

15. GENUS AND SPECIES NAME OF CROP
Triticum aestivum

17. IS THE VARIETY A FIRST GENERATION HYBRID?
☐ YES ☑ NO

18. DOES THE VARIETY CONTAIN ANY TRANSGENES? *(OPTIONAL)*
☐ YES ☑ NO
IF SO, PLEASE GIVE THE ASSIGNED USDA-APHIS REFERENCE NUMBER FOR THE APPROVED PETITION TO DEREGULATE THE GENETICALLY MODIFIED PLANT FOR COMMERICALIZATION. _____

19. CHECK APPROPRIATE BOX FOR EACH ATTACHMENT SUBMITTED
(Follow instructions on reverse)

a. ☑ Exhibit A. Origin and Breeding History of the Variety
b. ☑ Exhibit B. Statement of Distinctness
c. ☑ Exhibit C. Objective Description of Variety
d. ☐ Exhibit D. Additional Description of the Variety *(Optional)*
e. ☑ Exhibit E. Statement of the Basis of the Owner's Ownership
f. ☑ Voucher Sample *(2,500 viable untreated seeds or, for tuber propagated varieties, verification that tissue culture will be deposited and maintained in an approved public repository)*
g. ☑ Filing and Examination Fee ($3,652), made payable to "Treasurer of the United States" *(Mail to the Plant Variety Protection Office)*

20. DOES THE OWNER SPECIFY THAT SEED OF THIS VARIETY BE SOLD AS A CLASS OF CERTIFIED SEED? *(See Section 83(a) of the Plant Variety Protection Act)*
☑ YES *(If "yes", answer items 21 and 22 below)* ☐ NO *(If "no", go to item 23)*

21. DOES THE OWNER SPECIFY THAT SEED OF THIS VARIETY BE LIMITED AS TO NUMBER OF CLASSES?
☑ YES ☐ NO
IF YES, WHICH CLASSES? ☒ FOUNDATION ☒ REGISTERED ☒ CERTIFIED

22. DOES THE OWNER SPECIFY THAT SEED OF THIS VARIETY BE LIMITED AS TO NUMBER OF GENERATIONS?
☐ YES ☑ NO
IF YES, SPECIFY THE NUMBER 1,2,3, etc. FOR EACH CLASS.
☒ FOUNDATION ☒ REGISTERED ☒ CERTIFIED
(If additional explanation is necessary, please use the space indicated on the reverse.)

23. HAS THE VARIETY (INCLUDING ANY HARVESTED MATERIAL) OR A HYBRID PRODUCED FROM THIS VARIETY BEEN SOLD, DISPOSED OF, TRANSFERRED, OR USED IN THE U. S. OR OTHER COUNTRIES?
☑ YES ☐ NO
IF YES, YOU MUST PROVIDE THE DATE OF FIRST SALE, DISPOSITION, TRANSFER, OR USE FOR EACH COUNTRY AND THE CIRCUMSTANCES. *(Please use space indicated on reverse.)*

24. IS THE VARIETY OR ANY COMPONENT OF THE VARIETY PROTECTED BY INTELLECTUAL PROPERTY RIGHT *(PLANT BREEDER'S RIGHT OR PATENT)*?
☐ YES ☑ NO
IF YES, PLEASE GIVE COUNTRY, DATE OF FILING OR ISSUANCE AND ASSIGNED REFERENCE NUMBER. *(Please use space indicated on reverse.)*

25. The owners declare that a viable sample of basic seed of the variety has been furnished with application and will be replenished upon request in accordance with such regulations as may be applicable, or for a tuber propagated variety a tissue culture will be deposited in a public repository and maintained for the duration of the certificate.

The undersigned owner(s) is(are) the owner of this sexually reproduced or tuber propagated plant variety, and believe(s) that the variety is new, distinct, uniform, and stable as required in Section 42, and is entitled to protection under the provisions of Section 42 of the Plant Variety Protection Act.

Owner(s) is (are) informed that false representation herein can jeopardize protection and result in penalties.

SIGNATURE OF OWNER	SIGNATURE OF OWNER
D. C. Coston	
NAME *(Please print or type)*	NAME *(Please print or type)*
D.C. Coston	
CAPACITY OR TITLE: Assoc. Director-OAES	DATE: 4/11/05
CAPACITY OR TITLE: Assoc. Director-OAES	DATE

(See reverse for instructions and information collection burden statement)

INSTRUCTIONS

200500243

GENERAL: To be effectively filed with the Plant Variety Protection Office (PVPO), **ALL** of the following items must be **received** in the PVPO: (1) Completed application form signed by the owner; (2) completed exhibits A, B, C, E; (3) for a seed reproduced variety at least 2,500 viable untreated seeds, for a hybrid variety at least 2,500 untreated seeds of each line necessary to **reproduce** the variety, or for tuber reproduced varieties verification that a viable *(in the sense that it will reproduce an entire plant)* tissue culture will be deposited and maintained in an approved public repository; (4) check drawn on a U.S. bank for $3,652 ($432 filing fee and $3,220 examination fee), payable to "Treasurer of the United States" *(See Section 97.6 of the Regulations and Rules of Practice.)* Partial applications will be held in the PVPO for not more than 90 days, then returned to the applicant as unfiled. Mail application and other requirements to Plant Variety Protection Office, AMS, USDA; Room 401, NAL Building, 10301 Baltimore Avenue, Beltsville, MD 20705-2351. Retain one copy for your files. All items on the face of the application are self explanatory unless noted below. Corrections on the application form and exhibits must be initialed and dated. **DO NOT** use masking materials to make corrections. If a certificate is allowed, you will be requested to send a check payable to "Treasurer of the United States" in the amount of $432 for issuance of the certificate. Certificates will be issued to owner, not licensee or agent.

Plant Variety Protection Office
Telephone: (301) 504-5518
FAX: (301) 504-5291
Homepage: http://www.ams.usda.gov/science/pvpo/pvpindex.htm

To avoid conflict with other variety names in use, the applicant must check the appropriate recognized authority and provide evidence that name has been cleared by the appropriate recognized authority before the Certificate of Protection is issued. For example, for agricultural and vegetable crops, contact: Seed Branch, AMS, USDA, 10301 Baltimore Avenue, Suite 401 NAL Building, Beltsville, MD 20705. Telephone: (301) 504-5682 http://www.ams.usda.gov/lsg/seed.htm.

ITEM

19a. Give:
(1) the genealogy, including public and commercial varieties, lines, or clones used, and the breeding method;
(2) the details of subsequent stages of selection and multiplication;
(3) evidence of uniformity and stability; and
(4) the type and frequency of variants during reproduction and multiplication and state how these variants may be identified

19b. Give a summary of the variety's distinctness. Clearly state how this application variety may be distinguished from all other varieties in the same crop. If the new variety is most similar to one variety or a group of related varieties:

(1) identify these varieties and state all differences objectively;
(2) attach statistical data for characters expressed numerically and demonstrate that these are clear differences; and
(3) submit, if helpful, seed and plant specimens or photographs (prints) of seed and plant comparisons which clearly indicate distinctness.

19c. Exhibit C forms are available from the PVPO Office for most crops; specify crop kind. Fill in Exhibit C (Objective Description of Variety) form as completely as possible to describe your variety.

19d. Optional additional characteristics and/or photographs. Describe any additional characteristics that cannot be accurately conveyed in Exhibit C. Use comparative varieties as is necessary to reveal more accurately the characteristics that are difficult to describe, such as plant habit, plant color, disease resistance, *etc.*

19e. Section 52(5) of the Act requires applicants to furnish a statement of the basis of the applicant's ownership. An Exhibit E form is available from the PVPO.

20. If "Yes" is specified *(seed of this variety be sold by variety name only, as a class of certified seed)*, the applicant **MAY NOT** reverse this affirmative decision after the variety has been sold and so labeled, the decision published, or the certificate issued. However, if "No" has been specified, the applicant may change the choice. *(See Regulations and Rules of Practice, Section 97.103).*

23. *See Sections 41, 42, and 43 of the Act and Section 97.5 of the regulations for eligibility requirements.*

24. *See Section 55 of the Act for instructions on claiming the benefit of an earlier filing date.*

22. CONTINUED FROM FRONT *(Please provide a statement as to the limitation and sequence of generations that may be certified.)*

23. CONTINUED FROM FRONT *(Please provide the date of first sale, disposition, transfer, or use for each country and the circumstances, if the variety (including any harvested material) or a hybrid produced from this variety has been sold, disposed of, transferred, or used in the U.S. or other countries.)*

August 5, 2004 Foundation seed sold for increase purposes by the Oklahoma Foundation Seed Service

24. CONTINUED FROM FRONT *(Please give the country, date of filing or issuance, and assigned reference number, if the variety or any component of the variety is protected by intellectual property right (Plant Breeder's Right or Patent).)*

NOTES: It is the responsibility of the applicant/owner to keep the PVPO informed of any changes of address or change of ownership or assignment or owner's representative during the life of the application/certificate. The fees for filing a change of address; owner's representative; ownership or assignment; or any modification of owner's name is specified in Section 97.175 of the regulations. *(See Section 101 of the Act, and Sections 97.130, 97.131, 97.175(h) of the Regulations and Rules of Practice.)*

ST-470 (04-03) designed by the Plant Variety Protection Office using Word 2002.

EXHIBIT A—BREEDING HISTORY 20050243

ENDURANCE-A NEW HRWW FOR OKLAHOMA AND THE GREAT PLAINS

Origination and Breeding Procedure

Endurance was tested as OK94P549-11, which was an $F_{11:20}$ line (in 2004-2005) derived from a single-head selection from OK94P549, an OSU breeding line that originated from the former hard red winter wheat breeding program of Pioneer Hi-Bred International, Inc. The original advanced line from Pioneer was called HBG0624, and it had been selected from the three-way cross, HBY756A/Siouxland//2180. HBY756A was a Pioneer breeding line with an unknown pedigree, but incomplete records indicate it was a complex cross involving at least two soft red winter wheat parents, a CIMMYT spring wheat, and the final parent in the pedigree was TAM 105. Hence, the approximate parental contributions to OK94P549-11 are TAM 105 (13%), Siouxland (25%), and 2180 (50%).

The F_1 and subsequent bulk generations were evaluated within the Pioneer program. OK94P549 descended from an $F_{4:5}$ head row selected at Manhattan, KS in 1990 and grown in the "Pioneer Short Rows-1" nursery at Manhattan and Hutchinson, KS in 1991 (A.K. Fritz, personal communication, 2003). It was then entered into the 1992 Pioneer Observation Nursery, coordinated by Dr. Rollie Sears, former wheat breeder at Kansas State University, which was distributed to cooperating breeding programs in the Great Plains in the fall of 1991. This nursery contained 140 early-generation lines developed by Pioneer. OK94P549 traces to one of two sister lines with the KSU-assigned entry number 34. Both were named HBG0624.

The Pioneer Observation Nursery was grown in 1991-1992 at Stillwater and Lahoma, OK, and seed were harvested in bulk from Lahoma field plot 92LA3434. The subsequent generation was evaluated in a non-replicated observation nursery at Stillwater and Lahoma for leaf rust resistance, lodging resistance, plant height, heading date and maturity, spike appearance and density, within-line uniformity, test weight, seed quality, and grain yield. The line was selected, designated OK94P549, and entered into multi-location testing for the next 3 years. General observations during this testing phase indicated good yield potential across many environments, a lack of phenotypic uniformity (primarily height), and a high level of leaf rust resistance.

From a breeder-seed increase plot at Lahoma in 1996, 200 heads were selected from OK94P549 for line purification and seeded in a head-row reselection nursery in 1997. From these head rows, 25 were selected at Stillwater in 1997, and evaluated in non-replicated observation nurseries seeded at Stillwater and Lahoma the following year. Three distinct phenotypes based on plant color and stature were detected among the 25 reselections. On the basis of phenotypic uniformity, plant stature, test weight, and grain yield, four reselections were advanced to multi-location replicated yield trials in 1999. One of these reselections was designated OK94P549-98-6611, and its test weight was slightly above average at 59.3 lb/bu and its yield was well above average at 4909 kg/ha, compared to the other reselections.
From 1999 to 2003, OK94P549-98-6611 was evaluated in the following nurseries, representing 51 site-years in Oklahoma:

Replicated Yield Trials 1 - Central Core	1999
Oklahoma Elite Nursery 1	2000
Oklahoma Elite Nursery 2	2001-2003
Southern Regional Performance Nursery (SRPN)	2003
Wheat Variety Trials	2003, 2004

OK94P549-98-6611 was renamed OK94P549-11 in 2003. This line and its parent, OK94P549, have undergone 13 years of breeding and performance evaluation at OSU since the

southern breeding materials of Pioneer were donated to public programs in 1991. Of the 13 years, eight were dedicated to multi-environment testing. Dr. Ed Smith led the development and reselection of OK94P549, ending with the harvest of the reselections in 1998. Dr. Brett Carver has been responsible for the evaluation of OK94P549-11 and the sister reselections from 1998 to present. OK94P549-11 was also tested in the 2001 Regional Germplasm Observation Nursery (RGON), and its end-use quality was externally examined in the 2003 Hard Winter Wheat Milling and Baking Evaluation Program sponsored by the Wheat Quality Council.

OK94P549-11 was officially released as "Endurance" by the Oklahoma Agricultural Experiment Station and the USDA/ARS in 2004. It is a hard red winter wheat, *Triticum aestivum* L. Foundation seed will be produced and distributed by the Oklahoma Foundation Seed Service, Inc.

Application no. 200500243, Wheat, Common, Endurance

Addendum to Exhibit A

Endurance has been observed to be uniform and stable for three generations over a 3-yr period from 2003 to 2005. No phenotypically distinguishable variants were observed.

Revised Exhibit B - Statement of Distinctness

Most Similar Variety

Endurance most closely resembles the HRW wheat cultivar, Ok101, which shares 50% of its parentage with Endurance. The HRW cultivar, 2180, constitutes 50% of the cross of both varieties. Endurance and Ok101 were developed and selected for similar characteristics, such as acid-soil tolerance and grazing tolerance in a dual-purpose system. Distinctness may be drawn in three key areas: genotype for leaf rust resistance, genotype for a wheat-rye translocation, and phenotype for first-hollow-stem appearance.

Supportive Data to Declare Distinctness

1. Disease resistance

   Endurance carries the *Lr*17 and *Lr*26 seedling resistance genes for leaf rust, whereas Ok101 carries the *Lr*3 gene (USDA-ARS Cereal Rust Disease Laboratory, St. Paul, MN).

2. Wheat-rye translocation

   Ok101 does not contain the T1BL-1RS translocation (0% frequency), whereas Endurance does contain the translocation, such that 28% of the plants of Endurance are homozygous for T1BL-1RS (R.A. Graybosch, USDA-ARS, Lincoln, NE).

3. First-hollow-stem appearance

   The ability to hold winter dormancy during the latter stages of vegetative growth constitutes a crucial trait for adaptation to early-planted, forage-plus-grain management systems such as the dual-purpose system. Dormancy retention is reflected in the length of hollow stem detected at the base of primary tillers (first-hollow-stem, FHS) during the period of canopy green-up and lift, which typically occurs in late February to early March in much of Oklahoma.

   Ok101 is considered to have an intermediate appearance of FHS, but Endurance is considered to show late appearance of FHS. This difference is reflected in the data provided in Table 1 (see attachment, "endurance pvp revision Table 1.xls"), which shows paired comparisons of Endurance vs. Ok101 based on plant tissues sampled at Stillwater, OK in each of two growing seasons (2004 and 2005). Ten random plants were sampled from each variety on 27 Feb. 2004 and 15 Feb. 2005, and the length of hollow stem was determined using procedures described by Redmon et al. (Agron J., 1995, 87:137-147). Variety means were compared within years by a one-tailed t-test, which was driven by our hypothesis that hollow stem appears later in Endurance than in Ok101.

   The paired comparisons reveal a consistent, significant difference ($P<0.01$) in each

year for length of hollow stem. Hollow stem development was more than twice as great for Ok101 compared with Endurance. Given that FHS stage is defined as the date at which 1.5 cm of hollow stem is visible, Endurance reached FHS 4 to 11 d later than Ok101 in 2004 and 2005. This key developmental difference was a primary motivation behind its release.

U.S. DEPARTMENT OF AGRICULTURE
AGRICULTURAL MARKETING SERVICE
SCIENCE AND TECHNOLOGY
PLANT VARIETY PROTECTION OFFICE
BELTSVILLE, MD 20705

Exhibit C

OBJECTIVE DESCRIPTION OF VARIETY
Wheat (*Triticum* spp.)

NAME OF APPLICANT (S)	TEMPORARY OR EXPERIMENTAL DESIGNATION	VARIETY NAME
Oklahoma Agricultural Experiment Station	OK94P549-11	ENDURANCE

ADDRESS *(Street and No. or RD No., City, State, Zip Code and Country)*

Oklahoma State University
139 Ag Hall
Stillwater, OK 74078 Attn: D.C. Coston

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PVPO NUMBER
20050243

PLEASE READ ALL INSTRUCTIONS CAREFULLY:

Place the appropriate number that describes the varietal character of this variety in the boxes below. Place a zero in the first box (e.g., [0][9][9] or [0][9]) when number is either 99 or less or 9 or less respectively. Data for quantitative plant characters should be based on a minimum of 100 plants. Comparative data should be determined from varieties entered in the same trial. Royal Horticultural Society or any recognized color standard may be used to determine plant colors; designate system used: _____. Please answer all questions for your variety; lack of response may delay progress of your application.

1. KIND:

[1]
1 = Common
2 = Durum
3 = Club
4 = Other (Specify) _____

2. VERNALIZATION:

[2]
1 = Spring
2 = Winter
3 = Other (Specify) _____

3. COLEOPTILE ANTHOCYANIN:

[1] 1 = Absent 2 = Present

4. JUVENILE PLANT GROWTH:

[2] 1 = Prostrate 2 = Semi-erect 3 = Erect

5. PLANT COLOR: (boot stage)

[2]
1 = Yellow-Green
2 = Green
3 = Blue-Green

6. FLAG LEAF: (boot stage)

[2] 1 = Erect 2 = Recurved
[2] 1 = Not Twisted 2 = Twisted
[1] 1 = Wax Absent 2 = Wax Present

7. EAR EMERGENCE:

[0][3][1] Number of Days (Average)
[0][6] Number of Days Earlier Than * Scout 66
Same As * 2137, 2174, and Ok102
[0][3] Number of Days Later Than * Jagger

**Relative to a PVPO-Approved Commercial Variety Grown in the Same Trial*

8. ANTHER COLOR:

[1] 1 = Yellow 2 = Purple

8

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9. PLANT HEIGHT: (from soil to top of head, excluding awns)

[0][8][7] cm (Average)

[0][3] cm Taller Than Jagger, 2174, and 2137 *

Same As Overley *

[0][3] cm Shorter Than Thunderbolt *

10. STEM:

A. ANTHOCYANIN

[1] 1 = Absent 2 = Present

B. WAXY BLOOM

[1] 1 = Absent 2 = Present

C. HAIRINESS (last internode of rachis)

[1] 1 = Absent 2 = Present

D. INTERNODE

[1] 1 = Hollow 2 = Semi-solid 3 = Solid

[5] Number of Nodes

E. PEDUNCLE

[1] 1 = Erect 2 = Recurved 3 = Semi-erect

[4][5] cm Length

F. AURICLE

[1] Anthocyanin: 1 = Absent 2 = Present

[1] Hair: 1 = Absent 2 = Present

11. HEAD: (At Maturity)

A. DENSITY

[2] 1 = Lax
2 = Middense (Laxidense)
3 = Dense

B. SHAPE

[1] 1 = Tapering
2 = Strap
3 = Clavate
4 = Other (Specify) _____

C. CURVATURE

[3] 1 = Erect
2 = Inclined
3 = Recurved

D. AWNEDNESS

[4] 1 = Awnless
2 = Apically Awnletted
3 = Awnletted
4 = Awned

12. GLUMES: (At Maturity)

A. COLOR

[1] 1 = White
2 = Tan
3 = Other (Specify) _____

B. SHOULDER

[5] 1 = Wanting 2 = Oblique
3 = Rounded 4 = Square
5 = Elevated 6 = Apiculate
7 = Other (Specify) _____

C. SHOULDER WIDTH

[2] 1 = Narrow
2 = Medium
3 = Wide

D. BEAK

[3] 1 = Obtuse
2 = Acute
3 = Acuminate

E. BEAK WIDTH

[2] 1 = Narrow
2 = Medium
3 = Wide

F. GLUME LENGTH

[2] 1 = Short (ca. 7mm)
2 = Medium (ca. 8mm)
3 = Long (ca. 9mm)

G. WIDTH

[1] 1 = Narrow (ca. 3mm)
2 = Medium (ca. 3.5mm)
3 = Long (ca. 4mm)

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13. SEED:

A. SHAPE

[1] 1 = Ovate
2 = Oval
3 = Elliptical

B. CHEEK

[1] 1 = Rounded
2 = Angular

C. BRUSH

[2] 1 = Short
2 = Medium
3 = Long

1 = Not Collared
2 = Collared

D. CREASE

[2] 1 = Width 60% or less of Kernel
2 = Width 80% or less of Kernel
3 = Width Nearly as Wide as Kernel

[2] 1 = Depth 20% or less of Kernel
2 = Depth 35% or less of Kernel
3 = Depth 50% or less of Kernel

E. COLOR

[3] 1 = White
2 = Amber
3 = Red
4 = Other (Specify) _____

F. TEXTURE

[1] 1 = Hard
2 = Soft
3 = Other (Specify) _____

G. PHENOL REACTION (See Instructions)

[0] 1 = Ivory
2 = Fawn
3 = Light Brown
4 = Dark Brown
5 = Black

H. SEED WEIGHT

[3][0] g/1000 Seed (Whole number only)

I. GERM SIZE

[2] 1 = Small
2 = Midsize
3 = Large

14. DISEASE: PLEASE INDICATE THE SPECIFIC RACE OR STRAIN TESTED

(0 = Not Tested 1 = Susceptible 2 = Resistant 3 = Intermediate 4 = Tolerant)

[2]	Stem Rust (*Puccinia graminis* f. sp. *tritici*)	[2]	Leaf Rust (*Puccinia recondita* f. sp. *tritici*)
[3]	Stripe Rust (*Puccinia striiformis*)	[0]	Loose Smut (*Ustilago tritici*)
[1]	Tan Spot (*Pyrenophora tritici-repentis*)	[0]	Flag Smut (*Urocystis agropyri*)
[0]	Halo Spot (*Selenophoma donacis*)	[0]	Common Bunt (*Tilletia tritici* or T. *laevis*)
[0]	*Septoria nodorum* (Glume Blotch)	[0]	Dwarf Bunt (*Tilletia controversa*)
[0]	*Septoria avenae* (Speckled Leaf Disease)	[1]	Karnal Bunt (*Tilletia indica*)
[1]	*Septoria tritici* (Speckled Leaf Blotch)	[2]	Powdery Mildew (*Erysiphe graminis* f. sp. *tritici*)
[3]	Scab (*Fusarium* spp.)	[0]	"Snow Molds"
[2]	"Black Point" (Kernel Smudge)	[0]	Common Root Rot (*Fusarium*, *Cochliobolus* and *Bipolaris* spp.)
[3]	Barley Yellow Dwarf Virus (BYDV)	[0]	Rhizoctonia Root Rot (*Rhizoctonia solani*)
[2]	Soilborne Mosaic Virus (SBMV)	[0]	Black Chaff (*Xanthomonas campestris* pv. *translucens*).
[1]	Wheat Yellow (Spindle Streak) Mosaic Virus	[0]	Bacterial Leaf Blight (*Pseudomonas syringae* pv. *syringae*)
[0]	Wheat Streak Mosaic Virus (WSMV)	[ ]	Other (Specify) _____
[ ]	Other (Specify) _____	[ ]	Other (Specify) _____
[ ]	Other (Specify) _____	[ ]	Other (Specify) _____
[ ]	Other (Specify) _____	[ ]	Other (Specify) _____

15. INSECT: (0 = Not Tested 1 = Susceptible 2 = Resistant 3 = Intermediate 4 = Tolerant)

PLEASE SPECIFY BIOTYPE (where needed)

[1]	Hessian Fly (*Mayetiola destructor*)	[ ]	Other (Specify) _____
[1]	Stem Sawfly (*Cephus* spp.)	[ ]	Other (Specify) _____
[1]	Cereal Leaf Beetle (*Oulema melanopa*)	[ ]	Other (Specify) _____

10

15. INSECT: (continued) 0 = Not Tested 1 = Susceptible 2 = Resistant 3 = Intermediate 4 = Tolerant

PLEASE SPECIFY BIOTYPE (Where Needed)

[1]	Russian Aphid (*Diuraphis noxia*)	[ ]	Other (Specify) _____
[1]	Greenbug (*Schizaphis graminum*)	[ ]	Other (Specify) _____
[1]	Aphids	[ ]	Other (Specify) _____

16. ADDITIONAL INFORMATION ON ANY ITEM ABOVE, OR GENERAL COMMENTS:

#7 EAR EMERGENCE: Number of Days = Days after March 31
#13G PHENOL REACTION = Unknown

Endurance is heterogeneous for the 1BL/1RS translocation, with 27% of the plants having the translocation.

Off-types = <1% light red chaff (Jagger color).

11

WHEAT DESCRIPTOR ILLUSTRATIONS

200500243

Section Numbers Correspond to the Numbers of the Sections on the Form

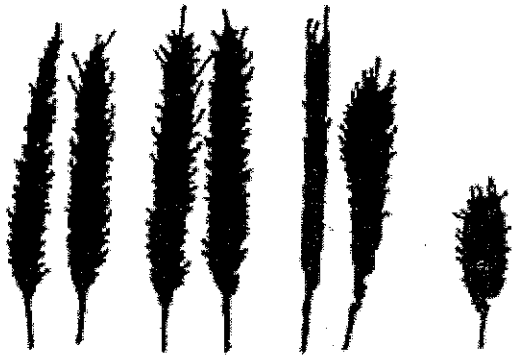
4. EARLY PLANT GROWTH HABIT:

1 Prostrate 2 Intermediate 3 Erect

10. STEM INTERNODE X-SECTION:

1 Hollow 2 Semi-solid 3 Solid

11. SPIKE SHAPE:

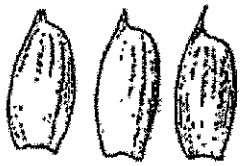


1 Tapering 2 Oblong 3 Clavate 4 Elliptical

11. AWNEDNESS:

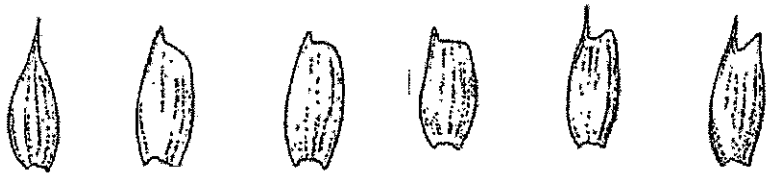
1 Awnless 2 Apically Awnleted 3 Awnleted 4 Awned

12. BEAK SHAPE:



1 Obtuse 2 Acute 3 Acuminate

12. SHOULDER SHAPE:

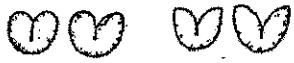


1 Wanting 2 Oblique 3 Rounded 4 Square 5 Elevated 6 Apiculate

13. SEED SHAPE:

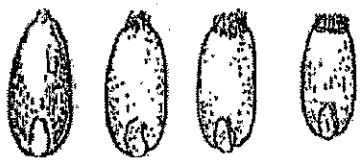
1 Ovate 2 Oval 3 Elliptical

13. CHEEK SHAPE:



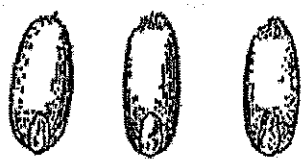
1 Rounded 2 AngulaR

13. BRUSH SIZE



1 Small 2 Midsized 3 Large 4 Collared

13. BRUSH HAIR LENGTH:



1 Short 2 Medium 3 Long

13. GERM (EMBRYO) SIZE:

1 Small 2 Midsized 3 Large

13. SEED CREASE WIDTH:

1 Narrow 2 Mid-wide 3 Wide

13. SEED CREASE DEPTH:

1 Shallow 2 Mid-Deep 3 Deep

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Quality assessment

The large-kernel fraction of Endurance is considered high (weighted mean of 70%), well above the target value of 60%, and equal to Ok101, a large-kernel cultivar, and typically greater than Jagger (55 %) and 2137 (64 %). Using the industry standard for estimating kernel weight by the SKCS, Endurance has a TKW of 29.5 g, based on 22 site-years during 2000 to 2003. Its TKW is expected to be 2-3 g greater than Jagger but similar to 2174 and Ok101. Kernel diameter of Endurance (2.29 mm) is considered relatively high in Oklahoma environments, although it was consistently surpassed by 2174 at 2.39 mm. Kernel diameter of Jagger is typically about 2.10 mm in Oklahoma. Kernel size attributes of Endurance should give it a desirable rating for milling quality.

Kernel hardness of Endurance (61) is intermediate to Ok101 (54) and Ok102 (74). In some environments, hardness values may drop below the industry standard value of 60, but well within values commonly observed for hard red winter wheat.

Wheat protein levels for Endurance have fluctuated since 2000 from about 11 to 12.5%, and it has averaged about 11.8% protein statewide. It exceeds Ok101 by about 0.5% protein, but has 1% less protein than Ok102. This level exceeds the industry minimum of 11.5%, but falls in the lower range of acceptability. Wheat-to-flour protein loss is 1.4%, close to the expectation of 1.5% for hard red winter wheat.

Based on laboratory-scale milling, Endurance has performed above average for straight-grade flour yield (Brabender Quadrumat Senior Mill) with a mean of 62.2%. It has performed intermediate to the high flour-yield check, Ok101 (62.9%) and Ok102 (61.5%). Given the favorable physical characteristics mentioned above and its record for flour yield, Endurance should be well suited for the hard wheat milling industry. This summation has been validated by the quality profile generated by ConAgra in 2002 for a seven-location grain composite, in which Endurance posted a good milling extraction (74.1%) with relatively low flour ash (0.37%). Respective values for Ok101 were 75.0% extraction with 0.47% flour ash, and for Ok102, values were 73.1% extraction and 0.53% flour ash. The exceptional combination of flour extraction-flour ash observed with Endurance suggests this cultivar may produce good product color and shelf life.

Endurance has shown moderate mixing time (nearly 5 min, across 22 environments), moderate mixing tolerance based on mixogram ratings (mean of 4.6 on a 1-10 scale), and mixogram curve width at 2 min past the peak (mean of 9.3 mm). Respective values were 4.8 mixogram rating and 9.1 mixogram curve width for Ok101, and 5.1 mixogram rating and 15.1 mm mixogram curve width for Ok102. Hence, Endurance has dough strength similar to Ok101 but lower than Ok102.

The baking performance of Endurance was assessed by OSU's Wheat Quality Laboratory and by ConAgra, Inc. Endurance is virtually indistinguishable from Ok101 and Ok102 in overall baking ratings, but notable differences emerge upon closer examination. Endurance scored well for internal loaf characteristics such as grain appearance, bread texture, crumb color, and slicing response, but showed some weakness in loaf volume and dough handling. These findings were confirmed by the Wheat Quality Council's evaluation of Endurance from the 2003 harvest. The Council also noted consistent strengths in crumb grain and color, but weakness in absorption (perhaps related to low flour protein). Overall baking quality of Endurance was judged as intermediate among all breeder samples submitted in 2003, but significantly lower than the superior check, Ok102. From these observations, it can be concluded that Endurance should be suitable for most commercial, large-scale baking operations.

Other Descriptive Information

1. Adaptation

   In the 2003 Southern Regional Performance Nursery (SRPN), Endurance ranked second in yield performance (4840 kg ha^{-1} versus the nursery mean of 4370 kg ha^{-1}) across the entire region, indicating a remarkably broad adaptation throughout the Great Plains.

2. Agronomic traits

   Endurance maintains a semi-erect to semi-prostrate growth habit throughout the vegetative period, with some variability expected according to seeding rate. Its canopy texture may be described as moderately fine and similar to Jagger, and with a leaf blade similar to Jagger. Similar to the comparison above, Endurance reaches the FHS stage about 2 weeks later than Jagger. Endurance is a moderately tall semidwarf and exceeds Ok102, a relatively short cultivar, by 8 cm, Ok101 by 5 cm, and Jagger and 2174 by 3 cm . Even with its late FHS stage, Endurance heads at the same time as Ok102 and 2174, 2 days later than Ok101, and 3 days later than Jagger. This combination of late FHS date and intermediate heading date indicates that Endurance is able to elongate rapidly, a critical adaptive response for a dual-purpose environment.

   Endurance possesses the same allele as 'Atlas 66' at the *ALMT1* locus on chromosome 4DL and shows no reduction in root elongation following exposure to 0.36 mM Al in nutrient-solution culture relative to the control treatment with 0 mM Al. This is substantiated by acid-soil tolerance ratings since 1999. It is in the same category as cultivars considered to be most tolerant, including 2137, Jagger, and Ok101. On a 1-to-5 scale (5=very susceptible), Endurance has a rating of 1.5, whereas Jagger and Ok101 carry the same rating and 2174, a less tolerant cultivar, has a rating of 2.7. Endurance has intermediate to moderately good straw strength based on lodging resistance ratings. However, it is not considered as strong as 2174, but similar to Ok101. On a 1-to-5 scale (5=very susceptible to lodging), Endurance has a rating of 2.6, whereas Ok101 has a rating of 2.8 and 2174 has a rating of 1.3.

3. Disease resistance

Disease	Reaction
Leaf rust (adult-plant)	Moderately resistant
Leaf rust (seedling)	Susceptible
Stripe rust (adult plant)	Intermediate to moderately resistant
Stem rust (adult plant)	Moderately resistant
Wheat soilborne mosaic	Moderately resistant
Wheat spindle streak mosaic	Moderately susceptible
Barley yellow dwarf virus	Intermediate (similar to 2174)
Septoria complex (leaf reaction)	Moderately susceptible
Tan spot	Moderately susceptible
Powdery mildew	Moderately resistant
Fusarium head blight	Intermediate

4. Cooperating Scientists

The hard winter wheat breeding team at Pioneer Hi-Bred International, Inc. is duly recognized for their development of HBG0624, from which OK94P549-11 was selected as a selfed progeny. Dr. Rollie Sears is recognized for selecting the family of lines named HBG0624 as candidates for distribution to cooperating programs in the Great Plains. Dr. Ed Smith tested the materials from Pioneer and eventually identified OK94P549.

Identification of OK94P549-11 as a candidate cultivar was accomplished by OSU's Wheat Improvement Team, which included Brett Carver (lead scientist), Gene Krenzer, Bob Hunger, Art Klatt, Jeanmarie Verchot-Lubicz, Patricia Rayas-Duarte, Arron Guenzi, Bjorn Martin, and David Porter. Also cooperating in the testing of OK94P549-11 were breeders and cereal chemists throughout the Great Plains associated with the Hard Winter Wheat Performance Nursery Program. The generous support of the Oklahoma Agricultural Experiment Station, the Oklahoma Wheat Commission, and the Oklahoma Wheat Research Foundation made this research possible.

U.S. DEPARTMENT OF AGRICULTURE
AGRICULTURAL MARKETING SERVICE

EXHIBIT E
STATEMENT OF THE BASIS OF OWNERSHIP

Application is required in order to determine if a plant variety protection certificate is to be issued *(7 U.S.C. 2421)*. The information is held confidential until the certificate is issued *(7 U.S.C. 2426)*.

1. NAME OF APPLICANT(S)	2. TEMPORARY DESIGNATION OR EXPERIMENTAL NUMBER	3. VARIETY NAME
Oklahoma Agricultural Experiment Station (OAES)	OK94P549-11	ENDURANCE
4. ADDRESS *(Street and No., or R.F.D. No., City, State, and ZIP, and Country)*	5. TELEPHONE *(Include area code)*	6. FAX *(Include area code)*
Oklahoma State University 139 Ag Hall Stillwater, OK 74078	(405) 744-5398	(405) 744-5269
	7. PVPO NUMBER	200500243

8. Does the applicant own all rights to the variety? Mark an "X" in the appropriate block. **If no, please explain.** ☑ **YES** ☐ **NO**

9. Is the applicant (individual or company) a U.S. national or a U.S. based company? **If no, give name of country.** ☑ **YES** ☐ **NO**

10. Is the applicant the original owner? ☑ **YES** ☐ **NO** **If no, please answer <u>one</u> of the following:**

a. If the original rights to variety were owned by individual(s), is (are) the original owner(s) a U.S. National(s)?
☐ **YES** ☐ **NO** **If no, give name of country**

b. If the original rights to variety were owned by a company(ies), is (are) the original owner(s) a U.S. based company?
☐ **YES** ☐ **NO** **If no, give name of country**

11. Additional explanation on ownership *(Trace ownership from original breeder to current owner. Use the reverse for extra space if needed)*:

PLEASE NOTE:

Plant variety protection can only be afforded to the owners (not licensees) who meet the following criteria:

1. If the rights to the variety are owned by the original breeder, that person must be a U.S. national, national of a UPOV member country, or national of a country which affords similar protection to nationals of the U.S. for the same genus and species.

2. If the rights to the variety are owned by the company which employed the original breeder(s), the company must be U.S. based, owned by nationals of a UPOV member country, or owned by nationals of a country which affords similar protection to nationals of the U.S. for the same genus and species.

3. If the applicant is an owner who is not the original owner, both the original owner and the applicant must meet one of the above criteria.

The original breeder/owner may be the individual or company who directed the final breeding. See Section 41(a)(2) of the Plant Variety Protection Act for definitions.